CALIFORNIA ENERGY COMMISSION

PROPOSED ENERGY SAVINGS GOALS FOR ENERGY EFFICIENCY PROGRAMS IN CALIFORNIA

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Summary

Energy Commission staff has analyzed the cost effectiveness and feasibility of rapidly ramping up energy efficiency program efforts over the next decade. As a result of this analysis, staff recommends the joint energy agencies set short term and long term energy efficiency savings goals for energy efficiency programs funded by public goods charges (PGC) and supplemental procurement decisions.[1] We recommend setting goals to achieve 7,000 GWh per year of annual savings from all energy efficiency programs[2] by 2006, 13,000 GWh by 2008 and 30,000 GWh by 2013.[3] Achieving the recommended long-term goal would be equivalent to reducing per capita electricity use by 0.3 percent per year over the next decade from 7145 kWh per capita in 2003 to 6930 kWh per capita in 2013. This is also equivalent to meeting roughly 50 percent of the projected increase in electricity usage over the next decade.

Our analysis finds that the cost effectiveness of available efficiency measures is probably not the limiting factor in achieving a large increase in effective electricity savings. Instead, our review of history suggests that there are other “structural” limits to achieving this “cost effective” potential including the difficulty in sustaining rapid increases in program funding within a regulatory environment. Frequent changes in the direction and magnitude of expected avoided costs, the extra costs of recruiting “late adoption” customers who represent the last 15 to 25 percent of a given efficiency market segment, remaining market, and the need to continually innovate and redesign approaches to reach the changing needs of an expanding and culturally diverse customer base.

It is worth noting that sustained reductions in per capita electricity use over a ten-year period have never before been achieved in any industrialized country in

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[1] This report did not consider the potential to achieve additional energy savings from building and appliance standards because this task would require the development of a different methodology. However, it may be a good idea to develop similar energy and peak savings goals for these programs on a three to five year cycle.

[2] These estimates include the savings projected from spending $225 million per year on electricity efficiency programs and incremental savings from the expanded or additional program efforts recommended in this report for the period from 2004 to 2013. The annual savings expected from both baseline and incremental efforts is shown in Appendix A.

[3] All estimates of annual energy and peak savings use a common baseline year of 2004 as the first year when savings are both estimated and begin to accumulate. Estimates of annual savings in a given year refer to the savings in a particular year that include the annual savings from all previous programs back to this base year of 2004. Estimates of cumulative electricity savings over the entire decade represent the annual savings achieved in each year summed over each year from 2004 to 2013. First year savings represents the electricity savings expected from one year of funding in the first year.

modern times. California's sterling record in maintaining roughly constant electricity use per capita of 7300 kWh over the last decade suggests achieving this magnitude of electricity reductions may be achievable. Our analysis suggests achieving this goal would require energy efficiency programs to achieve annual energy savings above 30,000 GWh per year by 2013. This would require achieving an average annual savings of 3,200 GWh per year from these programs; 2,000 GWh from new or expanded program efforts and the remaining 1200 GWh per year from the baseline energy efficiency programs currently funded at the level of $225 million per year.

We believe that simply setting a goal and establishing a method to track progress would be a significant accomplishment in and of itself.[4] We also believe that California's energy efficiency infrastructure will respond positively to the Energy Commission's adoption of electricity savings goals by increasing their marketing efforts and creating more efficiency choices for Californian's. For these reasons, we urge the Energy Commission to set specific energy savings goals for 3, 5 and 10-year increments as soon as possible.

Introduction

Policy makers in California have called for the establishment of aggressive savings goals for energy efficiency programs and renewable generation resources. This call was motivated in part by the success of energy efficiency programs and customer actions in reducing the probability for rolling outages in the summer of 2001 when peak demand was reduced by at least 3000 MW in 2001. This paper analyzes the remaining potential to save more electricity through investments in energy efficiency programs, recent trends in program effectiveness, and their effect on the underlying growth in electricity demand. Based on this analysis, we develop a short and long-term goal for electricity savings to be achieved by energy efficiency programs, appliance standards, and building standards.

In addition, the legislature has set a goal of producing at least 20 percent of the state's electricity generation using renewable resources for electricity generation over the next fifteen years. This paper combines the expected contribution of renewables with the goals set here to assess whether or not the state could achieve the goal of meeting all incremental electricity use over the next decade through efficiency programs and renewable generation resources.[5]
The public policy objectives to be achieved by setting and reaching an electricity savings goal include: minimizing future electricity procurement costs, reducing environmental emissions, including carbon dioxide emissions that contribute to

[4] The Energy Commission's statutory authority to set electricity savings goals is discussed in Appendix B.
[5] This report does not address the question of whether it would be economic to meet all new demand using efficiency or renewable electricity generation. This would require an analysis of how the load shapes of renewable resources match with the load shapes of the energy efficiency savings.

global warming, during peak periods, and providing a hedge against future price instability in the wholesale generation market. An important question for policymakers is how to select energy savings goals that represent a challenge or stretch for program administrators on the one hand, but do not divert scarce societal resources to achieving a high level of program savings that might not be cost effective or desirable in comparison to other alternatives available to meet customer's energy needs. This analysis seeks to strike that balance.

This paper builds off of some preliminary analysis in the Energy Commission's Public Interest Energy Strategies (PIES) report to recommend both near term and long-term savings goals for energy efficiency programs currently operated by Investor Owned Utilities (IOU), third parties, municipal utilities, and the state's energy agencies.[6] The preliminary analysis analyzed the energy impacts of different levels of overall program funding on the statewide forecast without consideration of how or whether current administrators could rapidly ramp up program funding levels to achieve additional electricity savings. In addition, the PIES analysis did not set a firm goal. This paper looks at these factors in more detail and develops proposed goals for the short and long-term.

Roadmap of the Report

This report is organized as follows:

- Section 1 identifies criteria for setting energy efficiency program savings goals.

- Section 2 reviews estimates of the economic potential to increase energy savings through programs that encourage the installation of energy efficiency measures and compares these estimates with the levelized cost of supply alternatives.

- Section 3 examines the feasibility of achieving higher annual energy savings levels in light of past program experience and trends in program cost effectiveness.

- Section 4 develops estimates of the program savings levels over the next decade that would be necessary to achieve with three different per capita electricity savings targets, ranging from achieving constant per capita electricity use to achieving a decline in per capita use of 1 percent per year.

- Section 5 recommends short and long-term energy savings goals based on the preceding analysis.

[6] Energy Commission Staff, Chapter 3, in *Public Interest Energy Strategies Report* (CEC Publication Number 100-03-012D, August 8, 2003).

- Section 6 proposes a process to use in monitoring progress towards these goals and making periodic adjustments based on program results and the observed demand for electricity.

- Section 7 summarizes the key findings from this analysis.

- Section 8 provides a recommended set of next steps.

Section 1 - Criteria to consider in Developing Efficiency Program Savings Targets

The following criteria should be used in setting electricity savings targets or goals for the next decade:

1. Targets should utilize current information on energy efficiency potential to define upper savings limits but be realistic in assessing the ability of programs to quickly ramp up spending to achieve maximum feasible or cost effective energy savings.

2. Targets should be consistent with past program administrator's experience in procuring and capturing energy savings and be consistent with future expectations regarding the timing of energy efficiency savings to meet base load, shoulder or peaking conditions.

3. Targets should be easily understood by practitioners in the energy efficiency industry and capable of being used as a motivational tool for public and private stakeholders.

4. Targets should be long term in nature. They should not be changed on an annual basis in response to cycles in utility procurement practices, generation contract signings, short-term market swings, or utility financial practices. They should be updated every two or three years, as more and more recent information becomes available.

In addition to consideration of these criteria, it is important to consider the effect that the addition of conservation resources will have on the overall portfolio of generation and transmission investments that will be used to meet customer energy needs. Expansion of energy efficiency program funding may be warranted for at least four separate economic reasons:

1. The cost of shifting or reducing the energy usage at a particular time of day is less than or equal to the cost of supplying the same energy needs via contracts with generation resources.

2. Investments in these efficiency programs as part of the overall portfolio of resources to meet systems demands can be shown to reduce the overall

risk of supply shortages, volatile prices, or reliability problems by diversifying risk.[7]

3. Investing in programs that have specific load savings profiles or geographic impacts will reduce or eliminate the environmental impacts from specific generation or transmission facilities identified as having "unacceptable" cost or other impacts on local communities.

4. Investments in these efficiency programs will reduce the financial risk faced by utilities and/or their customers from potential future regulation of carbon dioxide emissions.

We focus primarily on economic rationale number 1 in this paper but in some limited cases use the potential economic benefits flowing from items 2 and 4 to favor more investment in energy efficiency.

Section 2 - Review of Economic Potential for Energy Efficiency Programs

In the past two years, the investor owned utilities have funded a series of studies investigating the potential to increase the number of energy efficiency investments made by customers and businesses in specific segments over the next decade. This section uses the estimated cost and energy savings data from these reports to estimate the magnitude of savings that could be achieved by programs at a cost equal to or less than the projected cost of supply alternatives. In this section we build on the generalized cost of supply curves constructed in these reports by disaggregating measures into different parts of the utility load curve and examining the relevant marginal supply cost for each time period.

This section discusses how the estimated levelized cost of future energy efficiency programs can be used to bound or develop estimates of realistic increases in program funding. We conclude that the costs of new efficiency programs should be compared to the costs of providing generation in specific load blocks or shapes using either supply curves or levelized cost comparisons. This analysis then used to bound the likely range of program funding increases over the next ten years based on economic comparisons described in criterion #1 only. We do not have the time or the resources to scope out the additional value provided by consideration of criterion 2, 3, and 4 above. We note that this "omission" is likely to result in more conservative estimates of optimal future funding levels for energy efficiency programs.

The most recent evaluation of the potential to obtain increased savings from energy efficiency investments or "measures" in California was completed for the

[7] John Chamberlin, Don Bennett and Miriam Goldberg, *Exploratory Study of the Hedge Value of Energy Efficiency Investments* (Prepared by Kema-Xenergy Inc for PG&E, August 2003) report available at www.calmac.org.

Energy Foundation based on studies funded by the state's investor owned utilities. This study estimated the remaining potential to reduce energy usage by influencing customers to make energy efficiency investments over the next 10 years. The study examined estimates of market saturation for a list of over 200 measures for the residential, commercial and industrial sectors. Cost of conserved energy supply curves were generated that showed additional energy savings could be achieved equivalent to 10 percent of total electricity sales in 2011 at a levelized cost of less than 5 cents per kWh.[8] In this case, the cost of conserved energy includes program administration costs, incremental measure costs, rebate costs and marketing costs.

This overall "averaged" conservation supply curve presented in the Xenergy report does not discriminate between the load profile impacts of measures which primarily save energy use during peak periods and those which save energy on a daily basis year round. However, the study does present information that allows us to make this transformation using the conservation load factor (CLF) associated with each measure: CLF = Annual Average peak savings (kWh)/8760/System peak load savings (in kWh) per (hours in peak period). This information can be used to discriminate between energy savings from measures that will primarily affect demand during the base load, shoulder and peak load energy use time blocks in the following bins:

Type 1 - Base load - Efficiency Measures that save energy between 4380 to 8760 hours per year. Includes measures with CLF = or more than .51. Examples: (Lighting or cooling measures in facilities running 7 days per week, 24 hours per day or at least 90 percent of normal daylight operating hours.)

Type 2 - Shoulder - Measures that save energy between 1000 to 4379 hours per year. Includes measures with CLF = .12 - .50 Examples: Expected savings from most more efficient HVAC and lighting measures in commercial buildings.

Type 3 - Peak Savings - Measures save energy during system peak periods between 400-999 hours per year. Includes measures with CLF's from .01 to .12 Examples: Efficiency measures such as more efficient central air conditioners that primarily reduce residential cooling loads during the hot summer months only.

This peak savings category does not include super peak or "demand response" resources that can be called on to reduce load for the highest 50 to 100 hours per year. It also does not include the possibility of distribution companies using load management programs to reduce peak demand during high cost or

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[8] Mike Rufo and Fred Coito, XENERGY Inc., 2002. *California's Secret Energy Surplus: The Potential for Energy Efficiency*, prepared by XENERGY Inc. for the Energy Foundation and Hewlett Foundations, October, 2002). This study also was made possible by the efforts of Pacific Gas & Electric Company, which sponsored the anchor study on the commercial sector in 2001, and support from the California Energy Commission in early 2002 for the initial residential work.

emergency conditions. This would require a different methodology that would require tradeoffs between the costs of curtailing lighting or cooling systems and the value of reducing the probability of rolling blackouts, which is beyond the scope of this analysis.

Staff has constructed cost of conserved energy estimates based on the expected timing of energy savings from the energy measures included in the Hewlett Foundation study. The savings identified for each measure include the interactive effects on total savings from other efficiency measures that may be installed and affect the same end use, e.g., cooling, but do not take into account interactive effects across energy end uses such as the impact of reduced lighting wattages on the savings from cooling measures. This provides us with a better perspective of how much the energy savings from groups of efficiency measures will be available to meet specific load shape needs identified in the utilities' procurement process and their costs.

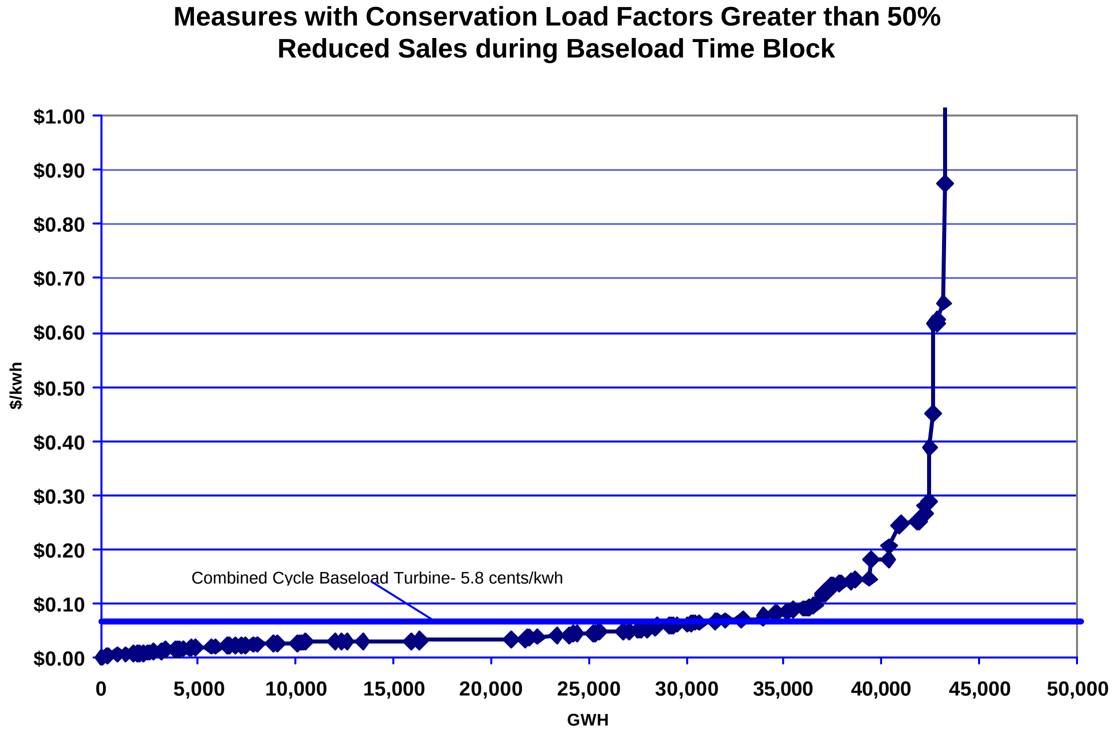
Potential to Achieve "Economic" Savings from Base Load Energy Efficiency Measures

Figure 1 provides an estimate of the annual GWh savings available from "base load" measures that operate for the majority of the year and thus generate savings during the base load period. The GWh savings numbers used in the figures below represent the summation of annual savings estimates from the Hewlett Foundation study but sorted by the time period of the expected impacts. These measures tend to have lower costs of conserved energy because the cost of achieving these savings is spread across a larger number of operating hours per year. However, these measures also face stiffer price competition from supply side alternatives whose levelized costs are also lower due to their higher utilization rates.

The relevant competitive supply option for this time period is a combined cycle gas turbine that can provide energy for 80 to 90 percent of the year with a levelized cost of 5.18 cents per kWh at the generation level. (Source: Energy Commission Electricity and Natural Gas Assessment Report, Appendix D). This estimate is adjusted upward to 5.8 cents per kWh to account for distribution and transmission line losses of 10 percent. This benchmark is included as a straight line in **Figure 1** below to determine what level of conservation investments are likely to be cost effective.

This cost estimate does not include any environmental adders or the potential value for reducing green house gas emissions at the margin. **Figure 1** shows how much annual energy savings could be purchased at different levels of annualized costs over the next decade.

Figure 1



Data Source: Xenergy, *California's Secret Energy Surplus*, (Hewlett Energy Foundation, October 2002)

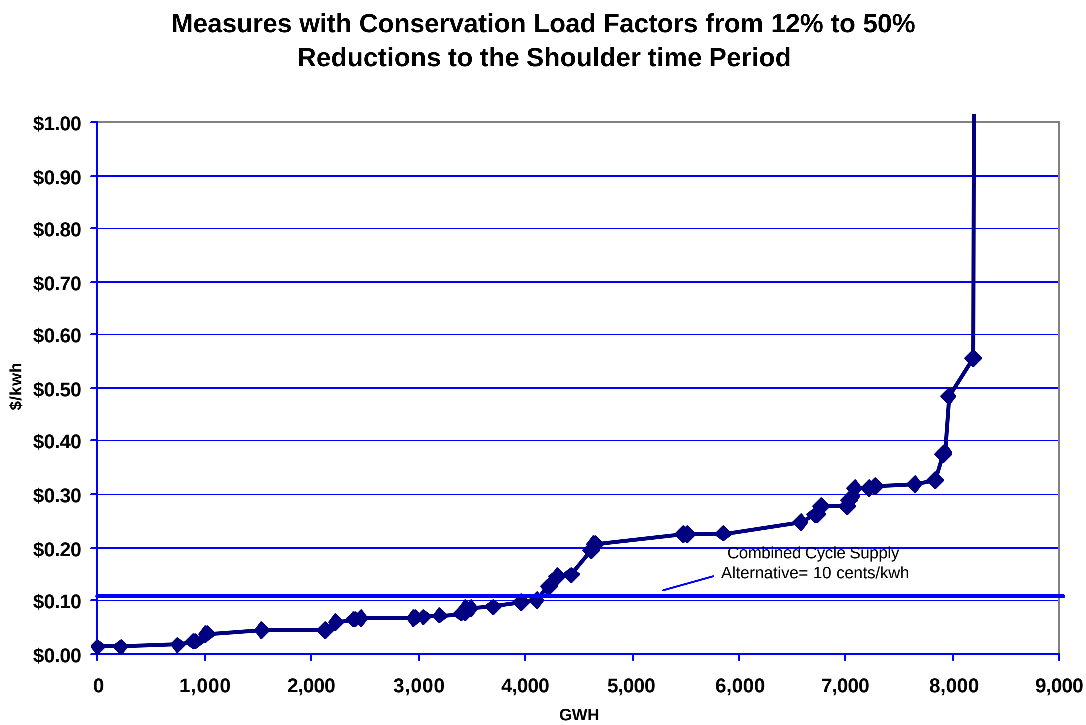
Based on this graph, it would be cost-effective to pursue savings of 29,300 GWh per year at a cost of 5.8 cents per kWh. Additional savings of 30,555 GWh could be obtained at 6.2 cents per kWh and 31,575 GWh could be obtained at 7 cents per kWh). This suggests that additional efficiency investments could be cost effective depending on the extent to which externalities currently not included in supply costs estimates are incorporated into prices over the next decade actual long-term cost chosen for the generation alternative. We choose to use the higher estimate of 7 cents per kWh because it is likely that the cost of externalities will begin to be internalized into electricity prices. Externalities estimates that have historically been valued at roughly 1 cent per kWh are not included in the 5.8-cent estimate. In addition and there is a possibility that natural gas prices will actually be higher than the forecasted levelized cost of natural gas from the Electricity and Gas Analysis. Thus, we choose to use the 7 cents per kWh levelized cost estimate to yield an estimate of 31,575 GWh per year of potential electricity savings.

We adjust this estimate of 31,575 GWh energy efficiency potential resources downward by 2,000 GWh per year to account for the reported program electricity savings in 2002 that have occurred since these curves were published in 2001. Thus, we reduce the 31,575 GWh per year potential estimate down to 29,575 GWh per year of achievable savings for the base load time period.

Potential for Achieving Energy Savings from Measures that Reduce Load during the Shoulder Time Period

Figure 2 shows the level of annual savings that could be achieved over the next decade at various prices during the shoulder time period, from 8 a.m. in the morning to 1 or 2 p.m. in the afternoon and the evening shoulder from 7 p.m. to 9 p.m. at night. Measures in this time period produce electricity savings for roughly 1500 to 4500 hours per year, similar to the hours of operation for businesses open for 10 hours per day on weekdays and closed on weekends. These measures have load factors that range from 0.17 to 0.50.

Figure 2



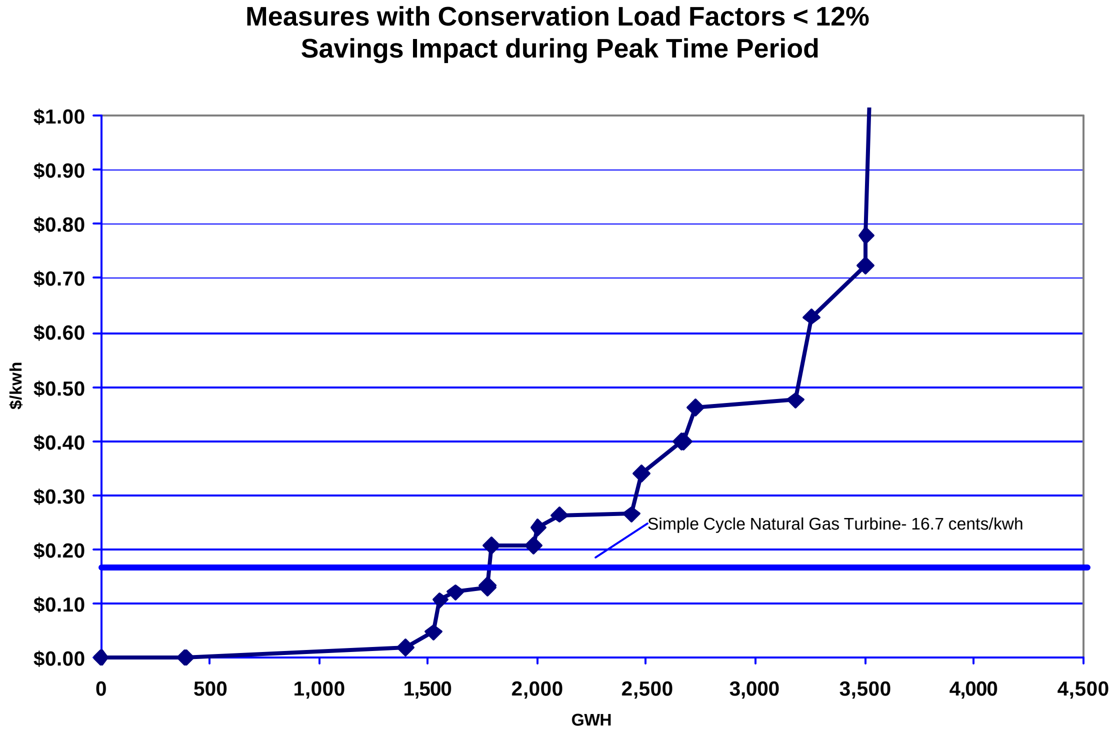
Data Source: Xenergy, *California's Secret Energy Surplus*, (Energy Foundation, October 2002).

The relevant supply cost benchmark for this group is probably a combined cycle turbine that operates from 1000 to 4300 hours per year. We estimate a levelized cost of supply based on a combined cycle power plant costing from 13 cents per kWh to operate 1,000 hours per year down to 6.3 cents while operating 4,000 hours per year. Taking 10.7 cents per kWh as the median in the range and adjusting it upward to 11.8 cents per kWh to account for line losses, the chart shows that an additional 4,000 GWh of energy efficiency can be purchased at a cost of 11.8 cents per kWh or lower.

Potential for Savings from Energy Efficiency Measures that Reduce Peak Load for up to 1000 Hours per Year

Figure 3 presents the annual potential savings and levelized costs for measures whose impacts fall primarily in the peak period. The peak period is defined as the 700 hours that occur between 12 p.m. and 7 p.m. on weekdays between May and October (7 hrs/day *20 weekdays/month *5 months).

Figure 3



Data Source: Xenergy, *California's Secret Energy Surplus*, (Hewlett Energy Foundation, October 2002).

The relevant supply cost benchmark for these measures depends to a large extent on market conditions that exist throughout the Western States grid on any given day. We know that high prices were paid for this type of energy in 2000 and 2001 that ranged from 25 cents to 50 cents per kWh. Appendix D in the staff Electricity and Natural Gas Report estimates the levelized cost of a simple cycle gas turbine is 15.1 cents per kWh, when operated for 823 hours per year, adjusting this for line losses results in a cost of 16.7 cents per kWh. A lower cost per kWh of 9.32 cents per kWh results if the gas turbine runs for at least 1000 hours per year. The levelized costs are much higher, roughly 25 cents per kWh, for a "pure" peaking plant which runs only 200 hours per year. Thus, the range of supply costs to serve peak demands in this time frame is between 9.32 cents and 25 cents per kWh. We choose to use the 16.7 cent estimate as a reasonable mid point.

For this analysis, we pick a conservative generation estimate near the low end of the range, 15 cents per kWh and then adjust for line losses to give a benchmark of 16.7 cents per kWh. **Figure 3** shows the intersection of this efficiency supply curve and 16.7 cents per kWh price results in an additional potential savings of 1750 GWh per year.

Summary of Conservation Supply Curve Analysis

Table 1 shows the expected total conservation resources that could be purchased at a cost lower than the supply benchmarks provided in the previous sections.

Table 1
Economic Potential by Resource Time Block

Resource Period (1)	***GWh Per Year (2)***	***Average MW[9] (3)***
Base Load (8760 hrs)	29,575	3,424
Shoulder (1200 hrs)	4,000	2,600
Peak (560 hrs)	1,750	3,125
Total Savings	35,325	9,149

Base load efficiency measures contribute 84 percent of the total savings in this chart, corresponding to the fact that base load hours represent roughly 83 percent of the hours in a year. Given the state’s current need to reduce peak load, program administrators may need to look at other types of efficiency measures targeted to reducing peak usage such as energy information and control systems. Consideration of time differentiated pricing rates and different types of demand response program could conceivably increase customer interest in investing in measures or systems that reduce peak loads but the smaller number of peak hours may make it harder for these investments to pay off. This would require the construction of a new type of demand response curves that are beyond the scope of this analysis.

This estimate of a potential to save 35,325 GWh per year using these three curves is slightly lower than the findings from the generalized cost of conservation curve analysis presented in the Energy Foundation Study. Their analysis showed that expansion of utility conservation programs could be used to increase annual energy savings from roughly 5 percent of total electricity sales today (12,500 GWh per year) to 13-15 percent of forecasted electricity sales in 2013 (34,000-45,000 GWh per year) at an averaged marginal cost below or equal to 10 cents per kWh.

[9] Average MW = # of GWh savings per number of hours in the time period of interest. The actual number of hours used is shown in the parentheses in Column 1. Example 30,000 GWh/8760 hours = 3,424MW.

Limitations to the Use of the Economic Potential Study Results

Before proceeding to the next section, we should note that there are some shortcomings of the Energy Foundation potential study that may bias any estimate of the actual energy savings that could be achieved from this data.

Factors suggesting the energy savings estimates may be too high include:

- Economic potential in the foundation study is based on the hypothesis that a 100 percent increase in customer rebate levels will lead to a 100 percent increase in customer measure adoption and ultimately measure penetration for some programs. We find this assumption to be too optimistic.

- Administrative costs of reaching and convincing the final 10 to 20 percent of customers who have not invested in a measure found to be cost effective on average may be significantly higher than the constant administrative costs per customer assumed in this model.

Factors suggesting these estimates may be lower than possible include:

- Estimates of the potential energy and peak savings from new industrial energy efficiency measures, energy management control system effects, and effect of dynamic pricing on the potential of firms to reduce their energy use were not addressed.

- The estimates of the level of energy savings that can be achieved by energy efficiency programs assumes current administrative framework for program administration will remain in place for the next decade. A new structure could potentially produce more savings per program dollar spent. This question is currently being reviewed by the CPUC.

- This study includes no estimates of the potential savings from new or emerging technologies bound to be invented and or introduced into programs over the next decade.

It is not reasonable at this time to predict or quantify how these factors are likely to interact and lead to either higher or lower savings estimates overall. Thus, we choose to use the best available estimate today and make revisions in the future.

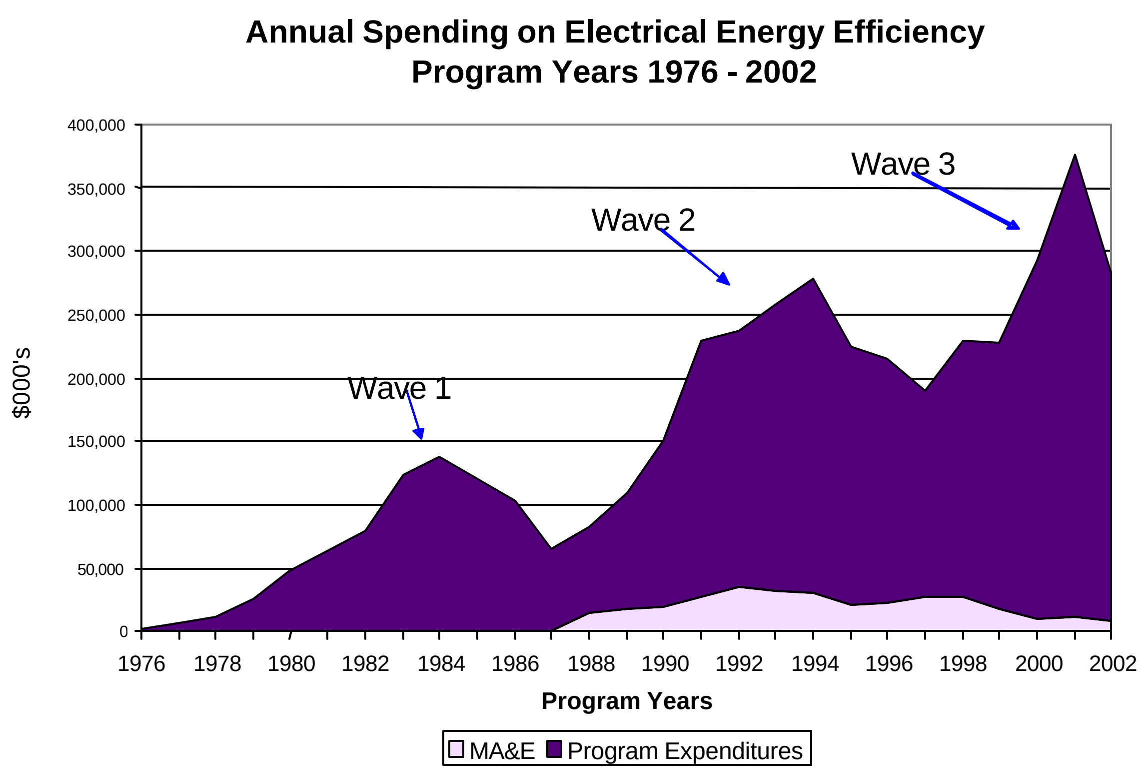
We conclude that the cost effectiveness of available efficiency measures is probably not the limiting factor in achieving a large increase in effective electricity savings for all ratepayers by 2013. Rather, there may be other limits to achieving this potential based on the costs of recruiting customers to participate, convincing them to invest via increased rebates or better information, and or the ability of program administrators to ramp up program funding to achieve the desired energy savings targets. These potential barriers are reviewed in the next section.

Section 3 - Feasibility of Achieving Additional Energy Savings Quickly Based on Previous Program Experience and Trends in Cost Effectiveness

Review of Previous Attempts to Quickly Ramp up Energy Savings from Energy Efficiency Programs

This section reviews the success of past attempts to quickly ramp up energy savings from utility administered energy efficiency programs over the last 20 years. Review of the historical record suggests there have been three waves of energy efficiency funding increases with corresponding but not proportionate increases in energy savings. It is interesting to note that in each of the cycles, funding generally increases for five to seven years and then begins to fall back for two or three years before a new wave begins again. **Figure 4** shows the overall pattern of expenditure for the last 27 years in nominal dollars.

Figure 4



Source: Utility Annual Report Filings for Investor owned utilities, Independent Evaluations for municipal utility programs; 1976-2002. Nominal $.

Table 2 presents the level of program funding and savings increases recorded in each of these three energy efficiency waves and contrast the annual rates of program funding and savings increases that proved feasible within each wave.

Table 2
Review of Energy Conservation Funding and Savings Cycles Over the Last 27 years

Wave Description and Timing	*Annual Funding and Savings at Bottom of the Cycle*	*Annual Funding and Savings Level at Top of the Cycle*	*Percent Increase in Funding or Savings-Bottom to Top (%)*	*Annual Percentage Increase in Funding and Energy Savings During the Wave Period (%/yr)*
Oil Crisis 1978-1984 Period = 7 years				
Funding $ MM	12	138	1047	50.2
Savings GWh/yr	747	1795	239	15.7
Integrated Planning 1988-1994 Period = 7 years				
Funding $ MM	68	247	261	23.9
Savings GWh/yr	645	1937	200	20.4
Electricity Crisis 1999-2002 Period = 4 years? (Or 7??)				
Funding $ MM	210	405	93	24.5
Savings GWh/yr	905	1938	114	28.9

All estimates shown above are in nominal $ and not adjusted for inflation.

Review of this data suggests several trends and possible limits to the capacity to achieve additional savings from energy efficiency programs funded through public goods charges or ratepayer funds:

1. The highest funding level for each of the three levels represents roughly a doubling of the highest spending from the previous wave. The program-funding peak was $138 million in wave 1, $247 million (+78 percent) in wave 2, and $405 million (+80 percent) in wave 3. This trend in wave peaks suggests that a fourth wave peaking in 2011 could hit $900 million if there were no other technical or economic constraints.

2. Actual energy efficiency program spending peaked in 2001, dropped substantially in 2002, and is likely to continue downward in 2003 and 2004 unless regulatory policy is changed.

3. Sustaining increases in program funding over a three to six year period is possible but is usually followed by a two to three year stable or down cycle in funding and savings achievements. Whether this phenomenon is the

result of market saturation effects or cycles in regulatory support for energy efficiency programs is unknown.

4. The percentage increases in recorded energy savings achieved over a three to four year ramp up period are usually lower and sometimes lag increases in program funding.

5. Annual and peak energy savings from energy efficiency programs have never increased above 2000 GWh per year for first year energy savings and 700 MW in peak demand savings.

6. Peak savings from all energy efficiency programs statewide did reach 1200 MW in 2001 but this is primarily due to the infusion of an additional $300 million in program spending in the same year.

7. Funding levels in the first year of a ramp-up period in the last fifteen years have never exceeded a 60 percent increase and usually ramp up at a level of 20 to 30 percent per year. This was not true for the initial ramp-up of energy efficiency program funding that went from 2 million in 1976 to $50 million in 1980. These “spending limits” are probably due to difficulties in hiring new staff, contractors and fielding new programs that would be faced by any administrator but could also be due to the structure of the organizations implementing the programs.

8. Despite the ebbs and flows of funding cycles, average annual spending on energy efficiency programs has trended upward at an impressive rate of 21.6 percent per year over 26 years.

Lessons learned from this review include:

1. A doubling or tripling of energy efficiency spending levels has never been achieved in one year and normally is spread over three to four years.

2. Gradually increasing funding levels over a three to six year period is likely to yield more energy savings and be more sustainable than a authorizing an 80 to 100 percent increase in funding during the first year of an expansion cycle. This is because the current administrative structure has historically encountered difficulties in actually spending the authorized level of funding during program ramp up periods. During the last ten years, utility program spending has only exceeded the authorized level for two of those years. On average actual program, spending has been 85 percent of the authorized level.

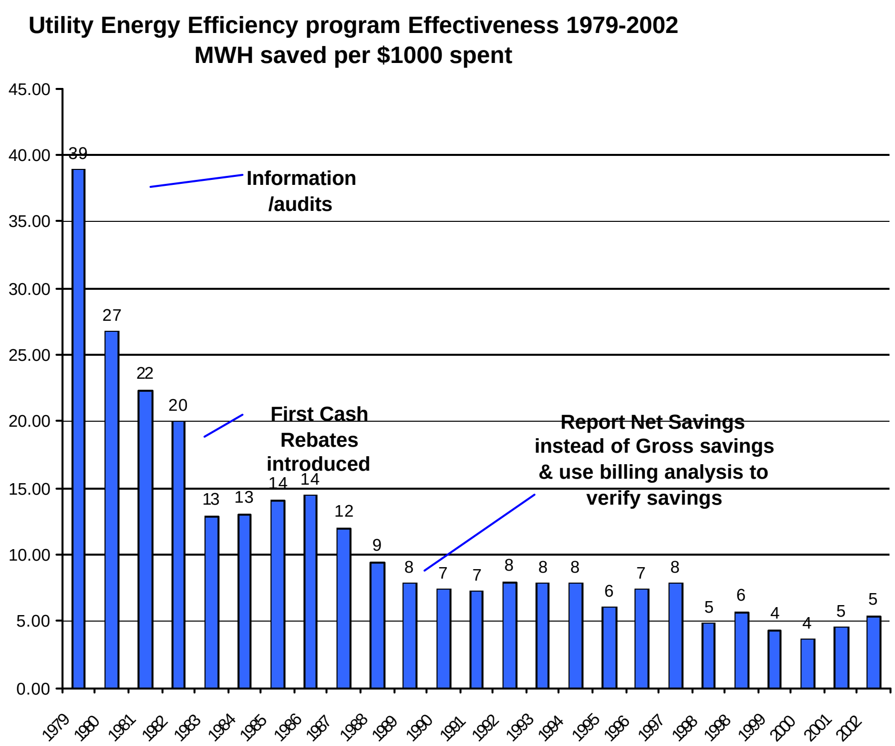
3. The maximum rate of increasing program funding over a five-year period appears to be in the range of annual program funding increases of 25 to 33 percent per year.

Review of Program Effectiveness Trends – Can the Trend Toward Decreasing or Flat Energy Savings Returns Per Dollar Spend be Reversed?

Analyzing the historical trends in efficiency programs' effectiveness in achieving energy savings or kWh saved per dollar spent is probably more important than our analysis of the cyclic nature of program spending to determine what level of energy savings could be achieved over the next decade. Forecasting the direction and slope of the trend in kWh saved per dollar spent is central to the question of not only whether the program-induced investments will be cost effective but also will determine to what extent these programs can significantly slow the overall growth in electricity sales.

Figure 5 presents an analysis of the MWH saved per dollar of program spending reported by utility and state program administrators over the last twenty-five years. The chart uses program cost (including cash rebates) and electricity savings data as reported by the investor owned and major municipal utility programs along with the reported savings from state agency programs in 2001 and 2002. The downward trend in program effectiveness is the product of a number of trends related to program content and measurement methods which are discussed below.

Figure 5
Trends in Utility Energy Efficiency Program Effectiveness
(Using Nominal Program Dollars)

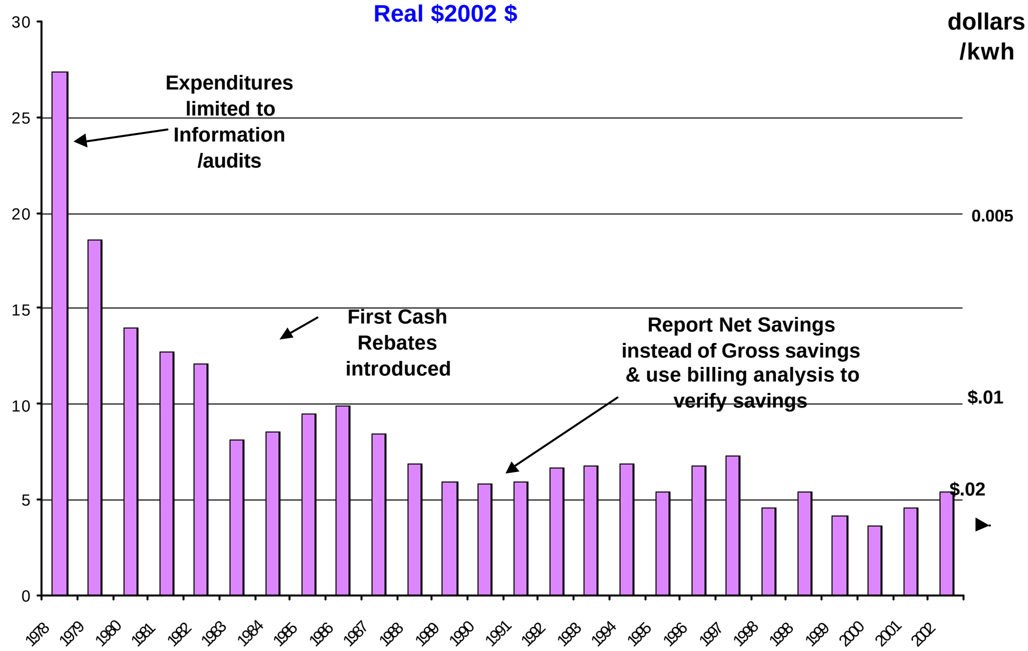


Source: Utility Annual Program Reports on Program Savings for all investor owned utilities in California: 1977 to 2002.

Figure 6 presents the same analysis in real dollars to remove the impacts of inflation over the 23 years. Removing the effects of inflation through the use of a GDP deflator series reveals a more gradual slope and accentuates the apparent increase in program effectiveness over the last three years. Of course, much of this increase is due to the significant effect that the rolling blackouts of 2000 and 2001 had on customer awareness. In essence, the electricity crisis may have had a similar effect to the receipt of millions of dollars of free advertising. Thus, it is not surprising to see a 20 to 30 percent increase in reported savings per dollar of program spending in the short run.

The program effectiveness numbers in these two figures are not directly comparable to the cost of conserved energy curves in the Xenergy analyses because they include first year savings/first year program costs as opposed to annualized costs/annualized savings over the program life. If we make the conversion from kWh saved per dollar and from first year to levelized lifecycle savings using a capital recovery factor of .10, this chart shows the cost of conserved energy per program dollar (for all investor owned utility programs and SMUD) went from 0.1 cents per kWh in 1976 to 2.5 cents per kWh in 2002. In other words, a program effectiveness ratio of 10kwh per $1.00 is the same as a levelized cost of 1 cent per kWh assuming an average measure life of 12 years. These cost estimates do not include the full incremental costs of purchasing the efficiency investments but do include the costs of program rebates, which in some cases approach or even equal the incremental cost of the more efficient measure.

Figure 6
Utility Energy Efficiency program Effectiveness 1979-2002
MWH saved per $1000 spent-
Real $2002 $



The downward trend in program effectiveness in both figures can be explained by major changes in both the types of energy efficiency programs run over the last two decades and measurement methods over time. At the beginning of the cycle, most of the utility programs provided recommendations via audits and information booklets but did not provide public funds as rebates to customers to reduce the cost of measures. Beginning in 1982 utilities began to offer cash rebates to residential and commercial customers for more efficient measures. Throughout the 1980's the program mix shifted toward offering customer rebates for specific measures which, as **Figure 6** shows, decreased the yield or kWh per dollar of program spending.

Periodic strengthening of California's building and appliance standards is another important factor that contributes to the decline in utility program effectiveness over time as measures that are promoted by programs in the early stages of their diffusion curve eventually become part of a mandatory standard. Major increases in the stringency of California's building and appliance standards requirements occurred in 1983, 1988, and 1994.

Most of these changes in program accounting rules, program mix and measurement changes contribute to the downward slope in program effectiveness. A similar change in measurement metrics led to a decline in reported savings between 1987 and 1990. In these years, utilities were ordered to report net program savings, which included a downward adjustment from 10 to 50 percent of gross savings to account for customers who report they would have made the energy efficiency investments independent of the program existence. In addition, utilities began to report savings from programs using billing analyses and control groups as opposed to simple engineering analyses during the same time frame. Both methodological improvements often led to slightly lower estimates of program savings.

In sum, the steep slope of declining program effectiveness in this chart is not necessarily indicative of declining administrative performance or market saturation. Most of the trend can be explained by changes in the type of programs delivered over time and changes in the measurement methods that reduced the reported program cost effectiveness. For example, program costs reported between 1978 and 1980 included only the costs of delivering the audit and no estimate of the cost of purchasing the more efficient measure. These structural changes mask any saturation effects or increased costs in either reaching customers or paying for the incremental costs of efficiency investments. The downward trend in this graph is consistent with the pattern of diminishing returns we would expect in most attempts to mine a commodity resource, be it energy efficiency potential or oil fields.

There are also some positive trends in this graph:

- The long downward slide in kWh saved per dollar spent appears to have stabilized in the last four or five years at an average value of 4.75 kWh per dollar or 2.1 cents per kWh on a levelized basis. (Assuming an average efficiency measure life of 10 years and a real discount rate of 4 percent per year.)

- Reported program effectiveness actually increased to 5 kWh per program dollar in 2001 and 2002 during the electricity crisis. This is due in part to the increased public receptivity to energy investments during the crisis.

- Additional general fund revenues of roughly $200 million per year were spent in 2001 and 2002 by state agencies to yield a significant increase in both GWh and MW saved. This spending also increased the overall program effectiveness ratio from 4.1 to 5.2 kWh per dollar program spending. However, these state agency programs are not assumed to continue due to lack of available general funds.

The important question for the future is whether one should assume that this stabilizing trend in program effectiveness is likely to continue for the next ten years or whether we should expect a continuation of the progressively lower energy savings per program dollar over time. We will address this question after reviewing the energy savings targets proposed in this proceeding.

Section 4 - Review of Proposed Energy Savings Goals and their Impact on the Expected Growth in Statewide Electricity Usage

This section reviews the impact of setting per capita reduction goals on the overall electricity forecast and then assesses the feasibility of using energy efficiency programs to reach those goals. The baseline growth in demand for electricity in California is projected to increase by roughly 18 percent over the next 10 years or 1.6 percent per year, from roughly 256,000 GWh to 300,000 GWh per year statewide in 2013. This forecast includes a projected rate of population growth of 1.41 percent per year, resulting in a population of 41 million persons by 2013. Thus, the baseline forecast translates to a small increase in per capita electricity use of 0.16 percent per year. This forecast includes the anticipated energy and peak effects of continuing to fund energy efficiency programs at $230 million per year for ten years.

Policy makers have searched for ways to reduce the expected increase in annual statewide electricity use of roughly 43,000 GWh over the next decade by either increasing spending for energy efficiency programs or increasing the rate of development of renewable generation. Policy makers have asked staff to review the feasibility of achieving a range of per capita electricity reductions goals ranging from maintaining the historical constant per capita use levels (of roughly 7145 kWh per capita) to reducing per capita usage by 1.0 percent per year over the next decade.

Table 3 illustrates the impact of achieving different levels of per capita savings goals on statewide electricity use over the next decade. The Energy Commission Baseline projection or forecast is for per capita electricity use to increase by 1.6 percent per year from 2003 to 2013. Each row in this table, labeled description of per capita energy use trend, illustrates the impact of achieving different per capita savings goals on statewide electricity use by 2013.

Table 3
Translation of Electricity Use Per Capita Goals into Statewide Electricity Use over the next Decade (2003 - 2013)

Savings Goal #	Description of per Capita Electricity trend	Percentage Growth in Elec Demand- 2013-2003	Electricity Demand in 2003	Electricity Demand in 2008	Electricity Demand in 2013	Additional Electricity Savings in 2013 required to meet goal	Annual Savings required to reach goal over 10 yrs =(prev col/10yrs)
	%/cap/year	%/year	GWh/yr	GWh/yr	GWh/yr	GWh/yr	GWh/yr
--	Baseline=0.16 % per capita/yr	1.57%	256,476	281,773	299,586	0	0.0
1	Constant electric use per	1.41%	256,476	276,717	294,954	4,632	463.2
2	Decline 0.3%/cap/year	1.10%	256,476	272,591	286,224	13,362	1336.2
3	Decline 0.5%/ca	0.90%	256,476	269,868	280,534	19,052	1905.2
4	Decline 1%/cap	0.39%	256,476	264,989	266,751	32,835	3283.5
5	Decline 1.5%/ca	-0.09%	256,476	256,806	254,059	45,527	4552.7

Table 3 allows us to identify the level of electricity savings needed to achieve each per capita savings goal by comparing the potential to achieve additional savings with the projected increases in electricity use for each goal (in Column 6). Achieving all of the 35,750 GWh of savings potential identified in Section 2 over the next decade would allow us to meet the per capita savings goal illustrated in rows 1 through 4 but not for row 5 (which requires annual savings by 2013 of 45,527 GWh per year). This economic potential result of 35,750 GWh is also 83 percent of the policy goal of achieving all of the incremental growth in electricity use during the decade of 43,110 GWh.

These projections also show that it will be very difficult to achieve Goal 5, the goal of holding statewide electricity use constant over the next decade by reducing per capita usage by 1.5 percent per year. The cumulative annual savings required by the last year, 2013, of 45,527 GWh, is 27 percent higher than the economic potential identified earlier.

However, the highest possible level of potential savings is not the only important factor in setting a goal. The earlier constraints to rapid program ramp up and the fact that the incremental savings produced by 2002 programs was only 1,363 GWh per year suggest it will be important to examine the expected timing and patterns of funding increases over the next ten years before setting a final savings goal.

Program Funding Trajectories Needed to Reach Each of these Savings Goals

Below we examine what levels of program funding and savings would be needed to reach each of these goals; consistent with the earlier discussion of the need to ensure the spending is cost effective and not rely on an unsustainable rapid ramp up of program funding levels to achieve a long term savings goal.

Table 4 presents the annual program spending and estimated annual incremental and cumulative program savings that would be necessary to achieve four different efficiency program goals: constant per capita electricity use, declining per capita use by .5 percent per year and declining per capita use by 1.0 percent per year.

Table 4
Match Between Per Capita Savings Goals, Program Funding Trajectories, and Energy Savings Achieved

Energy Efficiency Goal #	Per capita electricity use trends- 2003 to 2013	Growth in Electricity Demand- 2013-2003	Annual Program Spending by 2008 (a)	Annual Program Spending by 2013 (a)	Cumulative Savings Required over Decade to reach goal	Annual Energy Savings in 2013 - Base case
		%/year	$ millions	$ millions	GWh/yr	GWh/yr
Col # 1	2	3	4	5	6	7
Baseline Forecast	Increase by 0.16%/cap/ yr)	1.57%	*230.0*	*230.0*	*69,470*	*11,756*
1	Constant electric use per capita	1.41%	235.0	240.0	43,166	9,570
2	Decline by 0.3%/cap/yr	1.10%	430.0	700.0	88,275	20,126
3	Decline 0.5%/cap/year	0.90%	430.0	1,600.0	111,386	32,428
4	Decline 1.0%/cap /year	0.39%	768.0	4,252.0	182,545	42,502
Notes	**Economic potential for achieving energy savings was estimated to be 35,325 (Table1)**					
(a) Energy impacts in first row represent baseline forecast of funded programs, $230MM for the four IOU's and SMUD						
(b) all other funding levels are in addition to this base level of $230 MM/year from 2003 to 2013.						
© First year funidng ramp up constrained to 60% increase in first year						
(d) 2nd year and beyond program ramp up rates constrained to 33% per year for goals 1&2 and 50% per year for goal 3&4						

The first row provides the baseline level of program funding whose savings impacts are already included in the baseline forecast. A complete listing of the program funding levels calculated to be needed to meet each savings goal is presented in Appendix C. Rows 2 through 5, describe the energy savings necessary to achieve the savings goals identified in Columns 1 through 3. Columns 4 and 5 show the annual program spending required by 2008 and 2013 to meet the goal.

Column 6 shows cumulative program savings (annual program savings in each year summed over the ten-year period) necessary to achieve each of the goals. In other words, Column 6 is the savings area underneath the annual savings curve for the entire decade, while Columns 7 shows the highest level of annual savings achieved by the year 2013 under each scenario. The annual energy savings estimated in Column 7 assumes that program effectiveness is stable over the entire decade at 4.75 kWh per program dollar spent.

The annual energy savings projections in Column 6 for 2013 are based on a trajectory analysis of the feasible annual increases in program effort and savings over a decade. In each row, funding increases were limited to a 60 percent increase in the first year and 33 percent per year for the remainder of the decade. This is consistent with the previous analysis of trends. In addition, we constrain the number of years of steady (33 percent per year) program increases to five years and then require a consolidation period of two years before another program ramp up can begin. This mimics the spending levels achieved during the "down" cycles in energy efficiency funding over the last two decades.

The electricity savings levels presented Rows 2 through 5 of Table 4 in addition to the savings already included in the Energy Commission's forecast from the existing energy efficiency programs overseen by the CPUC. All of the estimated energy savings shown in these rows are in addition to the 69,470 GWh of cumulative energy savings (Row 1, column 6) over the next decade from Public Goods Charge funded baseline programs.

The analysis in this table suggests that savings Goals 1 and 2 could be achieved within the funding build up constraints discussed earlier and the conservative assumption of stable program effectiveness. Achieving savings Goals 3 or 4 would be technically possible but would require dramatic increases in program funding or a dramatic increase in the level of kWh savings achieved per dollar of spending.

This table suggests achieving the constant per capita electricity use goal (Goal 1) will require roughly a doubling of program funding from current levels. Achieving the 1 percent per year reduction in per capita use (Goal 4) would require an 18 fold increase in funding from $225 million per year to $4,252 million in 2013. Of course achieving this goal would also violate the funding ramp up constraints of 60 percent in first year and 33 percent per year used for all other years.

Potential for Increases or Decreases in Program Effectiveness Over Time

Table 5 presents a high and a low case of electricity savings that could be achieved using the same funding levels assumed in the previous table but different levels of program cost effectiveness. The rationale and derivation of the higher and lower numbers are discussed after the table.

Table 5

Forecasts of Program Electricity Savings Achieved by 2013
Under high and low Projections of Program Effectiveness

Energy Efficiency Goal #	Growth in Electricity Demand- 2013-2003	Cumulative Program Spending 2004-2013 (a)	Annual Energy Savings in 2013- Program Effectiveness constant at 4.75 kwh/$	Annual Energy Savings in 2013-- Program Effectiveness increases by 2.0%/yr	Annual Energy Savings in 2013- - Program Effectiveness decreases by 2.0%/yr
	%/year	$ millions	GWh/yr	GWh/yr	GWh/yr
Col # 1	2	3	4	5	6
Baseline Forecast	1.57%	*2,300.0*	*11,756*	*11,756*	NA
Incremental Program Scenarios above baseline					
1	1.41%	1,935.0	9,570	10,426	7,656
2	1.10%	4,150.0	20,126	23,016	16,101
3	0.90%	6,827.0	32,428	37,711	25,942
4	0.39%	13,963.0	42,502	51,387	34,002

High projection program effectiveness ratio starts at 4.75kwh/$ in 2003 and ends at 5.79 kwh/$ in 2013
Low projection program effectiveness ratio starts at 4.75kwh/$ in 2003 and ends at 3.88 kwh/$ in 2013

Table 5 bounds the potential changes in the level of electricity savings that could be achieved by 2013 if program effectiveness continues its upward trends of the last two years or begins to decline again as memories of the electricity crises and the conservation ethic fade from the public consciousness. The annual energy savings numbers in Columns 4, 5, and 6 show the different levels of electricity savings that would be achieved by 2013 under the base, high and low cases for program effectiveness. The assumption of a steady increase in program effectiveness in the high case reflects the possibility that a heightened awareness of energy concerns coupled with the possibility that the electricity crisis of 2000 will trigger a new wave of energy efficiency innovations and research that bring additional cost effective technologies to the market in the next decade. The assumption of a steady decrease in program effectiveness in the low case presumes that the long term decline in program effectiveness witnessed over the last two decade will persist although at a slower rate as the memory of the need to conserve fades from the public memory.

There is considerable uncertainty in both the slope and direction of the likely trend in program effectiveness over the next decade. We believe that careful observation and review of the actual program effectiveness ratios observed over the next three years is warranted. For now, we note that the program effectiveness assumptions used here can make a relatively big difference in overall program savings achieved. For example, these two assumptions create a difference in anticipated savings of roughly 20 percent in 2013 relative to the base case. Thus, these trends should be closely monitored and used to reassess and possibly modify the savings goals in the next goal setting proceeding.

In theory, increases in the kWh saved per program dollar could also be achieved by moving funds away from the harder to reach and less cost effective market segments currently served now and towards the more cost effective commercial or industrial customer programs. Alternatively, the state could move towards the use of more mandatory approaches such as the adoption of building and appliance standards when the saturation of a specific measure exceeded a lower threshold than currently used by the state. However, in our judgment, the chance of these changes in policy being accepted is not very likely in the short term. Thus, we reaffirm the conservative approach of assuming a constant kWh savings per dollar, rather than increases or decreases over the next decade.

Required Program Effort and Funding to Meet the Energy Savings Levels to Achieve the Per Capita Savings Goals

Below, we present our review of the required increases in program funding and savings to meet each of the energy goals in this table.

Achieving Goal 1, maintaining constant per capita electricity use for a decade appears to be feasible with roughly a doubling of annual program funding to achieve an incremental level of savings of 10,000 GWh per year (or a total savings of 22,013 GWh) by 2013. The funding increase is necessary to keep up with the expected population growth in California of 5 million people over the next decade.

Achieving Goal 2, a 0.3 percent per year reduction in per capita electricity use over the decade would require increasing program funding levels to $655 million per year by 2009 and $925 million by 2013. This funding would achieve incremental electricity savings in excess of 20,000 GWh per year by 2013. Achieving Goal 2 would be feasible if program effectiveness remains stable.

Achieving Goal 3, a decline in per capita energy use of 0.5 percent per year, would require roughly quadrupling the current expenditure level of $225 million per year by 2008 to $1.1 billion per year. This would require expanding program funding by 40 percent per year until 2013. This increase adds 32,428 GWh to the baseline projection of roughly 12,000 GWh from current funding levels to yield 44,000 GWh by 2013. This level exceeds the 35,325 GWh of savings found to be economic in comparison to supply alternatives in Section 2.

We conclude that while it may be technically feasible to meet the goal of meeting all incremental load over the next ten years[10] through investments in energy efficiency from these programs, it would not be wise or economic to adopt this aggressive goal until more experience is gained with respect to the state's ability to rapidly ramp up both funding and achieve incremental savings in the first few years of the proposed program ramp up. At this point in 2008, the cost effectiveness of continuing to expand funding and savings levels could be

[10] The estimated incremental growth in annual electricity usage for California from 2103 to 2013 is roughly 43,000 GWh per year or roughly 14 percent of the projected electric use of 298,000 GWh per year in 2013.

reassessed to determine if expansion beyond the savings levels tested in Goal 2 would be both feasible and desirable.

Achieving Goal 4, a 1 percent per capita decline in electricity use that equates to annual program savings of 54,000 GWh from all energy efficiency programs in 2013, would require funding increases of up to $4 billion per year in 2013. It is very unlikely that this level of funding could be supported or sustained by the current regulatory system. We believe that limits to the cost effectiveness of these programs would be reached long before this funding level was authorized.

Section 5 - Recommended Short and Long Run Energy Efficiency Goals

Long Run Electricity Savings Goals

We conclude that it may be possible to achieve program energy savings levels over the decade somewhere between the per capita savings goals of maintaining constant usage or reducing per capita usage by .5 percent per year. Staff recommends setting both a short-term, 5 year, and long-term, 10 year, energy efficiency goals at saving level of .3 percent per capita per year to reduced the expected growth in electricity use overall in California by 50 percent over the next decade. This goal would be equivalent to reducing per capita energy use by 0.3 percent per year over the next decade from 7145 kWh per capita in 2003 to 6930 kWh per capita in 2013.

It is worth noting that sustained reductions in per capita electricity use over a decade have never before been achieved in an industrialized country. However, California's record in maintaining roughly constant energy use per capita of 7300 kWh per capita over the last decade suggest this may be achievable. Reaching Goal 2 would require programs to achieve annual energy savings from all energy efficiency programs that accumulate to 30,000 GWh per year by 2013. This would require an average annual savings of 2,000 GWh from new program efforts in addition to current level of annual electricity savings from Public Goods Charge funded programs that has averaged 1240 GWh per year over the last ten years. Note that the last two years have seen a huge swing in annual program savings ranging from a reported 1650 GWh (excluding the 20/20 program) in 2001 to 1360 GWH in 2002.

Figure 7 illustrates the electricity savings from the baseline Public Goods Charge funded programs (already included in the staff baseline forecast) and the additional savings from an expansion of energy efficiency program efforts needed to meet this long-term goal (#2) of saving 30,000 GWh per year by 2013.

Figure 7

Long Term Electricity Savings Goal for Energy Efficiency Programs

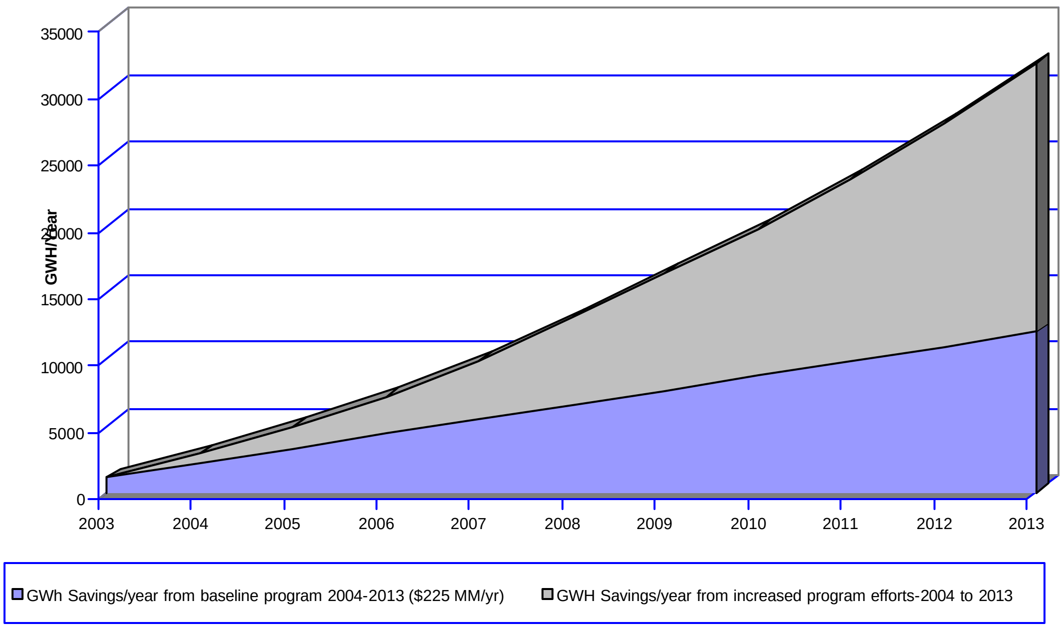
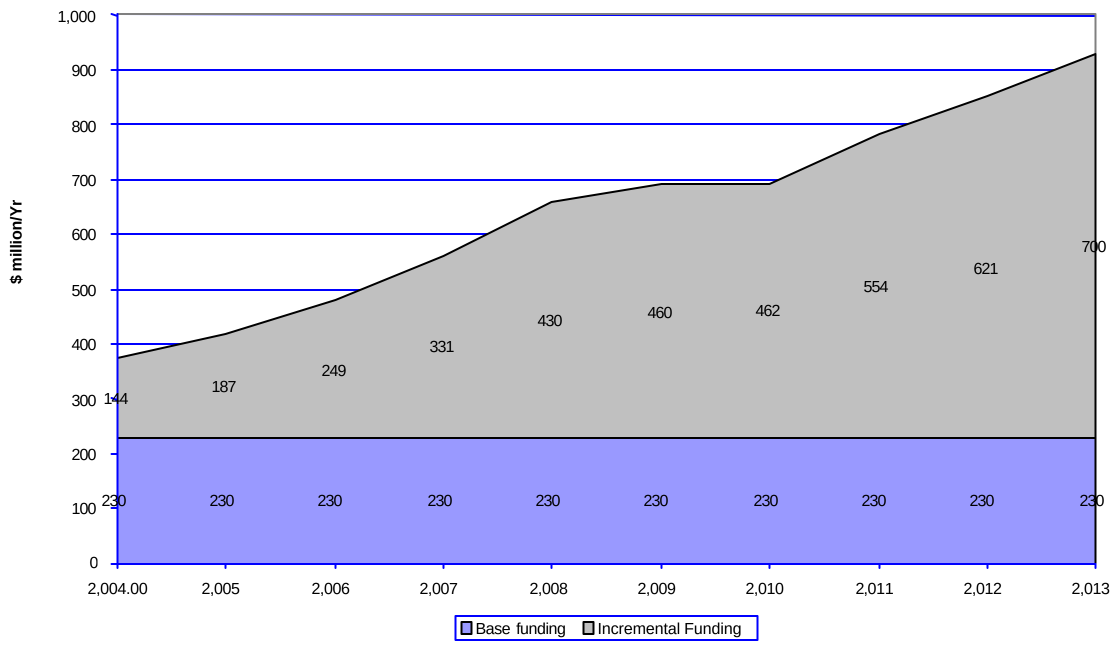


Figure 8 illustrates the funding levels that would be required if program effectiveness levels remain constant at 4.75 kWh per dollar over the decade (or a levelized cost of 2.1 cents per kWh with a 10 percent capital recovery factor). Meeting this goal would provide roughly 50 percent of the expected increase in electricity requirements of 43,000 GWh over the decade. Appendix A presents the annual spending and funding targets necessary to meet the long-term savings goals.

Figure 8

Funding Levels Needed to Reach Long Term Electricity Savings Goal of 30.000 GWh per Year by 2013 ($ million per year)



Near Term Electricity Savings Goals

To set the near term goal, it is important to examine the latest trends in electricity savings over the last two years. **Table 6** shows reported energy and peak savings from the investor owned utilities, municipal utilities, and California's energy agencies.

Table 6
Recent Funding and Electricity Savings Trends
For Energy Efficiency Program in California

Program Administrator	***2001 GWh/yr***	***Funding $ Millions***	***2002 GWh/Yr***	***Funding $ Millions***
Investor Owned Utilities	1,423	306.4	1,104	194.3
SMUD**	62	16.8	69	18.8
CEC	167	40.2	290	59.2
Other State Programs (20/20 and Flex Your Power and Residual Effects) ##	3,053	415.2	-	-
Total	4,705	778.6	1,363	372.3

**No program funding or electricity savings data is yet available for 2002 from LADWP and the other municipal utilities

##Estimates from Global Energy Partners, *California Summary Study of 2001 Energy Efficiency Programs* (CALMAC Study: March 13, 2003) residual effects include the impacts of price increases, rolling blackouts and extensive media coverage of the crisis.

The 2002 funding and savings estimates represent a 50 to 100 percent drop relative to program energy savings reported in 2001. In part, this is due to the fact that the 2002 totals reported for the investor owned utilities do not include $50 million in PGC funding that was redirected to Non-IOU administered programs in 2001. This is because the savings from these programs have not yet been reported or verified. However, the major difference is the huge surge in program funding for state programs precipitated by the electricity crisis. This additional funding from the general fund for state programs is not expected to reoccur in the near future.

The other significant factor to consider in the near term is the investor owned utilities' proposal to spend an additional $140 million per year (on top of the authorized $230 million for 2003) as part of the CPUC proceeding on utility procurement. A decision on these proposals is not expected until late 2003 so funding could not start until 2004.

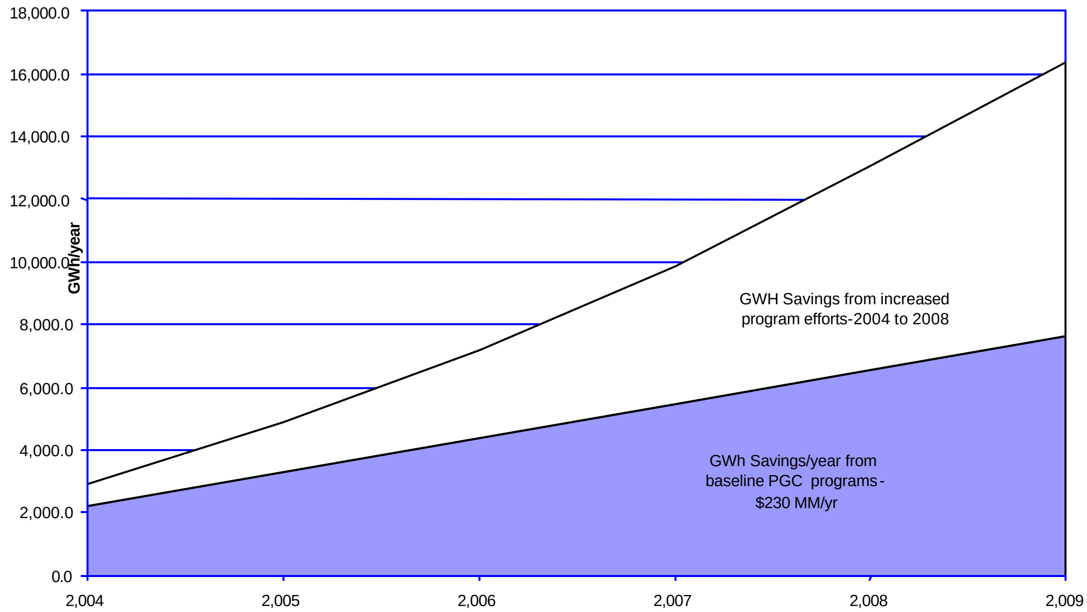
Both of the preceding factors, a slowdown in spending and regulatory uncertainty on what level of funding will be approved, will make it harder to reverse the downward trend in funding from 2001 to 2002 and begin another program ramp up cycle. We recommend setting bold or stretch energy savings targets to motivate the market to make this change.

We recommend setting electricity savings goals that are consistent with the previous energy savings ramp up experience of 60 percent per year in the first year and then 33 percent per year in the second or third year of a major program increase. This is consistent with the first year funding increase of 55 percent proposed by the investor owned utilities in the procurement process.

Figure 9 summarizes the recommended short-term electricity savings goals. The upper area represents incremental savings goals above and beyond the electricity savings from baseline programs shown in lower blue area. Electricity savings from the lower area are already included in the baseline forecast of electricity use. The actual incremental values for each year are shown in the upper area as well. We recommend setting near term energy savings goals of 7,000 GWh per year from all investor owned utility and municipal energy efficiency programs by 2006 and 13,000 GWh per year by 2008. The investor owned utility program should be asked to achieve roughly 80 percent of this goal while the municipal owned utilities should be asked to strive to achieve the remaining 20 percent of the statewide electricity savings goal.

Figure 9

Proposed Short Term Energy Savings Goals for California Energy Efficiency Programs 2004 – 2009



	2,003.0	2,004	2,005	2,006	2,007	2,008	2,009
GWh Savings/year from baseline PGC programs- $230 MM/yr	1,092.0	2,185.0	3,277.5	4,370.0	5,462.5	6,555.0	7,647.5
GWH Savings from increased program efforts-2004 to 2013	0.0	698.4	1,606.3	2,813.9	4,419.9	6,507.7	8,738.7
Total GWh	1,092.0	2,883.4	4,883.8	7,183.9	9,882.4	13,062.7	16,386.2

This figure and the supporting table illustrates how important it is to start the program ramp up as soon as possible in order to reach the high electricity savings levels required to meet energy savings Goals 2, 3, or 4 by 2013. Note that even with a relatively steep ramp up rate the incremental savings from increased program efforts does not exceed the cumulative annual savings expected from the baseline program efforts funded at $225 million per year until 2009, the last year of the short term period. This baseline impact forecast also does not include the potential energy savings from the additional program funding sought by investor owned utilities as part of the CPUC's procurement proceeding in late 2003.

These goals represent a balancing of the available savings potential and the review of history that suggests it will be difficult for three investor owned utility administrators to rapidly increase spending to levels 100 to 200 percent above current funding levels. Rapid funding increases will be particularly difficult given the fact that the CPUC is currently re-evaluating the system of program administration where utilities perform the majority of functions in the system. Achieving the savings in this table would require a funding increase from $230 million in 2004 to $660 million in 2009, nearly tripling over six years. This trajectory is achieved through program funding increases of 60 percent in Year 1, 30 percent in Year 2, and 33 percent per year out to 2009. This is a reasonably conservative trajectory on the way to the long-term goal of quadrupling program savings efforts by 2013.

Our intent is to set near term goals that will stimulate enough programmatic effort to make the long-term goal achievable. Policy makers should not make planning decisions based on achievement of the long-term savings goal until all parties can review the feasibility of gradually ramping up funding and savings from these programs over the next three years.

Achieving these short-term goals may also require a thoughtful evaluation of alternative methods of increasing the effectiveness of current program administrators to reverse the long-term trend toward lower conservation yields per program dollar spent. We are encouraged that the CPUC is investigating new mechanisms for selecting and administering energy efficiency programs that could provide more cost-effective program options.

Section 6 - Proposed Process to Monitor Progress Towards Goals and Make Periodic Adjustments

The effects of this significant funding increase over the first three years should be monitored yearly to see if the programs could continue to capture additional savings at the current program effectiveness rate of roughly 2 cents per kWh. After the first three years, in 2006, the agencies should reassess whether continued program expansion would be cost effective, given the additional savings achieved. The energy savings achieved and the efficacy of the new administrative structure should be independently reviewed in 2009. Additional energy savings could also be achieved from the development and adoption of new building and appliance standards beginning in 2008. We recommend that the joint energy agencies consult with the Energy Commission building standards staff, the codes and standards support staff at each investor owned utility, and the municipal utilities to develop energy savings performance goals for 2008 and 2013 that can contribute to the statewide total.

Following each triennial review, program delivery agents should be asked to adjust their program designs based on the load impact results for different program types and propose ways to increase electricity and natural gas savings during the next planning cycle.

Section 7 - Summary of Findings

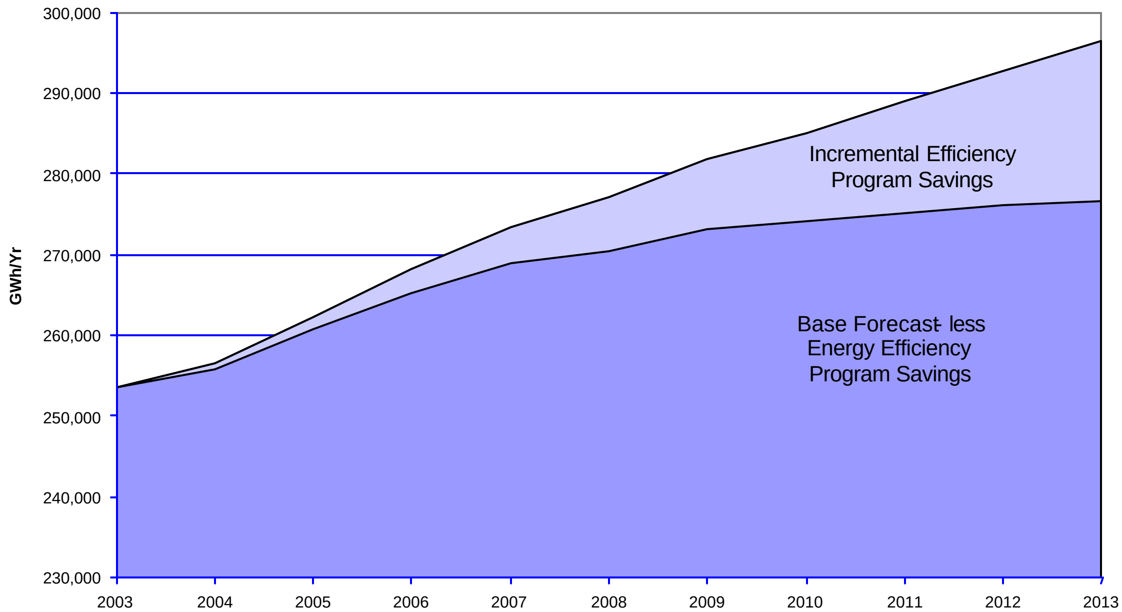
We recommend that the state adopt an energy savings goal equivalent to doubling the expected level of savings from the current public goods program by 2008 and tripling the overall level of expected electricity savings to over 30,000 GWh by 2013 (see Appendix A for details). Achieving the additional savings necessary to achieve a sustained reduction of 0.3 percent per capita per year would be unprecedented in the "history of energy policy", but California has already surprised the world by reducing its peak demand for energy by 8 percent in less than one year. Certainly increasing overall funding levels for energy efficiency programs by a factor of 3 over the next decade will stretch the capacity of the current planning and delivery structure. For example, over the last 25 years, annual savings from publicly funded energy efficiency programs overseen by the CPUC have never exceeded 2000 GWh per year but achieving the long term goal would require an increase to 4460 GWh per year of first year savings by 2013.

It is important not to underestimate the huge challenges program administrators will face in trying to achieve these long-term savings goals over the next decade, particularly given the roller coaster of program funding support observed over the last twenty-five years. Achieving this level of spending will necessarily entail a dramatic increase in both the number of program implementers hired to achieve energy savings in specific sectors and the level of participation of energy efficiency service professionals and vendors and perhaps a change in the administrative structure itself.

Figure 10 shows the projected impact of achieving Savings Goal 2, a decrease in per capita electricity use of roughly 3 percent over the decade, on the baseline Energy Commission forecast of electricity demand. The figure suggests that roughly 50 percent of the incremental growth in demand can be met by energy efficiency programs **if** additional funding is made available either through the public goods charge or through procurement decisions. The remaining incremental GWh system needs (the difference between the base usage of 253,000 GWh in 2003 and the expected usage of 276,508 GWh in 2013 if the efficiency goal number 2 is achieved) could be met through aggressive pursuit of the Renewable Portfolio Standard (RPS) for renewable generation plants. However, contributions from renewable power plants need to be balanced by consideration of the benefits and costs of adding other types of generation plants including gas fired combustion turbines and refurbishing existing plants. This topic is beyond the scope of this paper.

Figure 10

Impact of Achieving Additional Energy Savings on the Statewide Electricity Forecast



The cost of achieving additional savings from these programs could drop over time, depending on the pace of technical innovation and trends in overall energy costs. On the other hand, our analysis of the long-term trend in program effectiveness suggests that expecting a twenty-year trend toward higher costs per kWh of savings to reverse itself over the next ten years is not prudent. Thus, it is reasonable to assume that the level of kWh savings achieved per program dollar will remain constant at roughly current levels for the next decade.

Some analysts have remarked that choosing to rely on energy efficiency efforts to meet up to 50 percent of expected demand is a risky proposition. However, we believe this paper and other similar analyses support our overall conclusion that the benefits of achieving the recommended energy savings goals are worth the risk. California's ability to reduce energy usage and at the same time continue its economic growth would quickly set an example for the rest of the world.

Achieving this goal will require a multi-year commitment by state policy makers and program administrators to gradually ramp up program spending levels by a factor of 3 over the next 6 years and a similar ramp up of renewable procurement efforts. It is important to recognize there are other types of benefits to achieving these savings goals in addition to the fact that these efficiency resources are cheaper than the supply benchmark. A short list of the benefits expected if the ramp up in program funding achieves the estimated cumulative energy savings of roughly 200,000 GWh per year over the next decade.

- The additional efficiency savings achieved through these programs over the next decade will avoid the need to purchase roughly 150,000 GWh over 10 years; equivalent to ten years of annual output from a 2600 MW of power plant at a .65 capacity factor.

- Reduce the need for utility distribution companies to purchase strips of high priced energy during peak periods by peak by roughly 5000 MW by 2013.

- Reduce 8.2 million tons of green house gas emissions.[11]

- Achieve an additional $16 billion in energy savings (net present value) during the next decade at a cost of $4.4 billion in cumulative program expenditures.

Section 8 - Next Steps

The joint agencies should explicitly direct their staff to work with the existing program administrators and building standards staff to translate these statewide goals to program or utility area GWh and MW savings goals for each of the relevant program service territories. An example of the proposed goal format is presented in Appendix D. This translation step is necessary because per capita electricity savings goals have no meaning for program administrators or implementers until they are translated into annual GWH and MW targets. Per capita energy use trends also cannot be easily tracked because of unrelated changes in population trends (migration, birth rates, etc) and economic growth.

Simultaneously, the governing agencies should hire independent evaluation firms to track program administrator progress toward meeting goals and make sure that program administrators are part of the evaluation process but not managing the contractors. These firms should be given the task of reviewing all program evaluations to be conducted over the next three years, identify any obvious methodological errors, summarize the total program savings contribution toward the statewide goal, and reconcile them with actual energy usage over next three years to ensure there is consistency between the sum of bottoms up energy savings estimates and the top down view of actual energy usage trends. The results of the first three years of the program ramp up should then be presented to policy makers and legislators for review and modifications to the goals if necessary.

[11] Emission factor of 1100 lbs of CO_2 per MWH of generation from Pat McAuliffe based on simulation runs of PG&E system and mid point of the 8760-hour analysis.

Appendix A

Projected Level of Annual Peak and Energy Savings Required to Meet Long-Term Energy Savings Goal of Reducing Per Capita Usage by 0.3 Percent per Year for Next Decade (Includes GWH, MW and Funding levels by year)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
GWh Savings/year from baseline PGC programs- $230 MM/yr for 10 yrs	1,092.0	2,185.0	3,277.5	4,370.0	5,462.5	6,555.0	7,647.5	8,740.0	9,832.5	10,925.0	12,017.5
GWH Savings from increased program efforts-2004 to 2013	0.0	698.4	1,606.3	2,813.9	4,419.9	6,507.7	8,738.7	10,993.9	13,700.2	16,731.3	20,126.3
Total GWh	1,092.0	2,883.4	4,883.8	7,183.9	9,882.4	13,062.7	16,386.2	19,733.9	23,532.7	27,656.3	32,143.8
MW savings from Baseline PGC programs	0.0	565.4	848.1	1,130.9	1,413.6	1,696.3	1,979.0	2,261.7	2,544.4	2,827.2	3,109.9
Incremental MW from increased programs	0.0	180.7	415.7	728.2	1,143.8	1,684.1	2,261.4	2,845.0	3,545.3	4,329.7	5,208.3
Total MW	282.6	746.2	1,263.8	1,859.0	2,557.4	3,380.4	4,240.4	5,106.7	6,089.8	7,156.9	8,318.2
Total funding- $ MM per year	Total funding- $ MM per year	369.0	412.2	474.0	556.1	655.5	685.0	690.0	783.0	850.0	925.0

A. Incremental vs. Baseline Programs: Shaded rows (2 and 4) show incremental energy and peak savings from program funding beyond the $225 million in the baseline public goods charge. Unshaded first row is the impacts from baseline program. Total MW, GWh and funding shows combined impacts of baseline and incremental program funding.

B. Converting GWh to peak savings - Historically the relationship or conversion between GWh and MW savings has varied from .17 to .41, depending on the mix of measures being promoted by the utilities and the relative level of peak savings emphasis from the Energy Commission. If all of the energy savings from these programs were evenly spread across 8760 hours the conversion factor would be .114 (GWh*cf = MW). If all of the savings were entirely concentrated in the top 1000 peak hours, the conversion factor would be 1.0. For the purposes of this analysis, we use a conversion factor of .259 because this is the factor that would result if all of the measures found to be economic in our analysis were installed. This however results in a conservative or lower estimate of the peak savings in MW that could be achieved relative to the most recent program years. In recent program years, the conversion factors from energy to peak ranged from .41 in 2001 and .34 in 2002.

Appendix B

Energy Commission Authority to Set Electricity Savings Goals

Section 25000.1 of the Public Resources Code states:

(a) A principal goal of electric and natural gas utilities' resource planning shall be to minimize the cost to society of the reliable energy services that are provided by natural gas and electricity and to encourage the diversity of energy sources through improvements in energy efficiency…

(b) The legislature finds and declares that, in addition to any appropriate investments in energy production; electrical and natural gas utilities should seek to exploit all practicable and cost effective conservation and investments in the efficiency of energy use that offer equivalent or better system reliability and which are not being exploited by any other entity.

The Act goes on to require the Energy Commission to require analysis of energy savings levels and goals in Section 25305. Continuous studies, projects; reduction in wasteful and inefficient uses; potential sources.

"The commission shall continuously carry out studies, research projects, data collection, and other activities required to assess the nature, extent, and distribution of energy resources to meet the needs of the state, including, but not limited to, fossil fuels and solar, nuclear, and geothermal energy resources. It shall also carry out studies, technical assessments, research projects, and data collection directed to reducing wasteful, inefficient, unnecessary, or uneconomic uses of energy, including, but not limited to, all of the following:

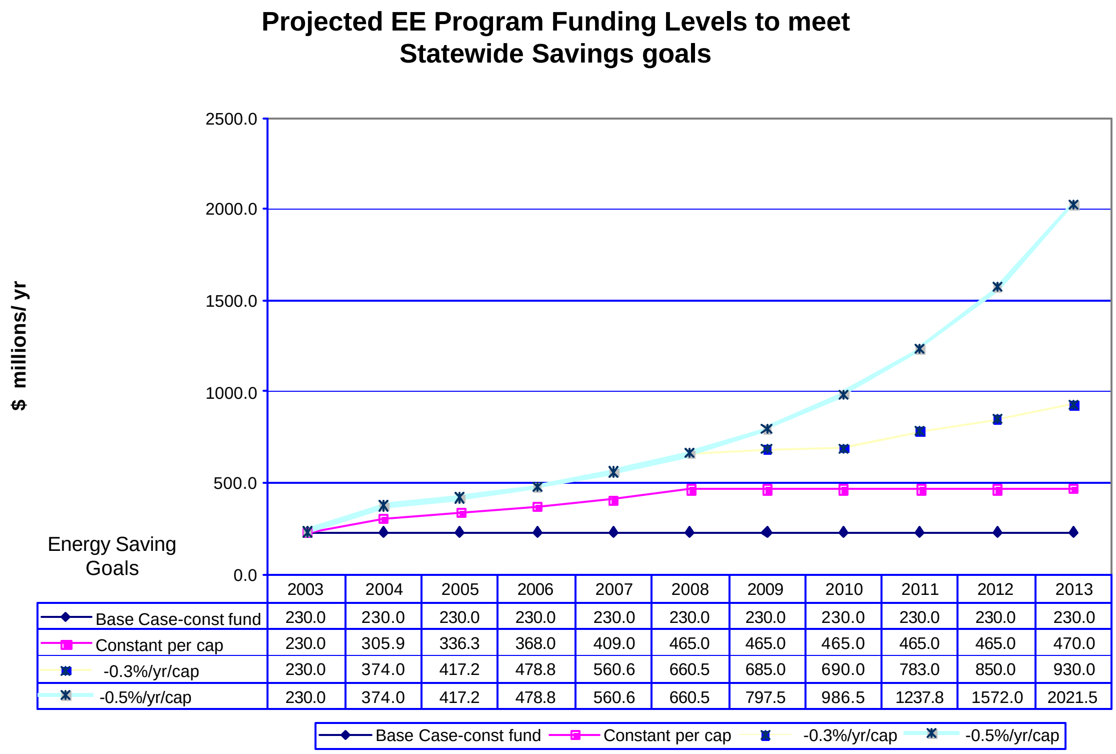
(a) Pricing of electricity and other forms of energy.
(b) Improved building design and insulation.
(c) Restriction of promotional activities designed to increase the use of electrical energy by consumers.
(d) Improved appliance efficiency.
(e) Advances in power generation and transmission technology.
(f) Comparisons in the efficiencies of alternative methods of energy utilization"

Summary

In our judgment, these statues provide the Energy Commission with the authority to forecast electricity use and set electricity savings goals for both municipal and investor owned utilities. In addition, we believe the CPUC has more than adequate statutory authority to set such goals for the investor owned utilities.

Appendix C

Program Funding Levels Calculated to Meet Each of the Savings Goals



Energy Saving Goals	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Base Case-const fund	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0
Constant per cap	230.0	305.9	336.3	368.0	409.0	465.0	465.0	465.0	465.0	465.0	470.0
-0.3%/yr/cap	230.0	374.0	417.2	478.8	560.6	660.5	685.0	690.0	783.0	850.0	930.0
-0.5%/yr/cap	230.0	374.0	417.2	478.8	560.6	660.5	797.5	986.5	1237.8	1572.0	2021.5

Appendix D

Example Format for Three and Five Year Program Savings Goals-

Service Territory and or Statewide Program Description	Savings Goals	2006	2006	2008	2008
		GWh/yr	MW	GWh/yr	MW
PG&E					
SCE					
SDGE					
SMUD					
LADWP					
Savings Goal suggested in report for sum of utility areas above (1)		7,184	1,859	13,062	3,380
Statewide Savings from Appliance or building Standards		??	??	??	??
Total Goal					
Notes					

(1) GWh and peak savings Goal are computed based on a start date of 2004 programs, thus 2006 goal would be the sum of program savings from 2004,2005 and 2006.These number correspond to recommended savings level to achieve energy savings goal #2, a -0.3%/capita/year goal or an overall reduction in forecast of statewdide consumption from 1.57% forecast to 1.1%/year from 2003 to 2013.

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